Pan American Health Organization

Regional Office of the World Health Organization

Hurricane Ivan in the Caribbean
Final Report

03 June 2005

Background

Hurricane Ivan hit the Caribbean, beginning on 7 September 2004. As it fluctuated between categories 3 and 5, it affected Barbados, Grenada, St. Vincent and the Grenadines, Jamaica and the Cayman Islands. The southern tip of Cuba and the Yucatan Peninsula of Mexico were spared a serious hit. Grenada was the most affected with about 90% of the island's buildings reported with some kind of damage. The island's only referral hospital, St. George's, was severely damaged. The Princess Alice hospital was left completely non-functional.

As Ivan headed toward Jamaica between Friday and Saturday, 10-11 September, the storm veered west, reducing the anticipated impact on the island. Preparedness measures included the evacuation of thousands of potential victims.

Three days after Hurricane Ivan struck the Cayman Islands, communications were still difficult and the airport was not fully operational. Extensive flooding affected low lying areas of the island. 90% of the West Bay area of Grand Cayman suffered damage and communication with the Eastern District was cut off.

Grenada

Virtually every citizen of Grenada has been affected by Hurricane Ivan and an estimated 90% of the buildings suffered moderated to severe damage. Therefore, the beneficiary of this project was the entire population of Grenada.

Grenada main hospital in St. George's was only partially damaged; however, Princess Alice Hospital in Granville, Richmond Home for the Elderly, Carlton House (drug rehabilitation centre), and several health centers stopped functioning completely.

Coordination

A PAHO disaster response team was deployed as soon as the airstrip was cleared (two days after Ivan). It included public health experts, health services, biomedical engineers, a structure engineer and disaster experts to conduct a rapid needs assessment in the health sector. Usually assessments are

conduct together with the Ministry of Health but in the case of Grenada the Ministry of Health was completely paralyzed and the Emergency Operation Centre (EOC) had very few staff and lacked water and electricity. (Attachment I rapid needs assessment).

Interagency meetings were held at the EOC (NERO). There were no separate health meetings as only a few agencies were involved in the health sector. One week after the hurricane, medical teams from Martinique, British Virgin Islands and OXFAM arrived in Grenada.

The general coordination was initially done in collaboration with CDERA and later on UNDAC teams arrived. It is worth mentioning the excellent coordination with the Regional Security System (RSS) – CARICOM Disaster Relief Unit, which proved once again the significance of inter-island solidarity, especially for smaller territories.

SUMA teams from British Virgin Islands (BVI) and Barbados were deployed to Grenada after the hurricane and installed at the airport, sea port and government warehouse at Point Salines. Some local staff already trained in SUMA were immediately recruited, while new volunteers were trained. Initially, it was very difficult to have an overview of the relief goods that arrived in the country and it was not possible to track what was left at the warehouse; however, the situation was corrected ten days after hurricane Ivan struck.

Logistics and communications were very difficult at the beginning of the operation due to lack of fuel, water and food, road damage or blockage, as well as the limited contact with the outside world. Teams of military and police from neighboring islands rapidly started to clear the roads.

Provision of Medical Supplies and Equipment

Medical supplies (such as basic drugs and antibiotics) in hospitals, clinics, and central medical stores, as well as equipment in laboratories were damaged.

PAHO purchased emergency health kits (enough for 10,000 people for three months) and laboratory equipment for St. George's Hospital, as well as, mattresses, generators, washers, dryers and other hospital supplies for the Princess Alice Hospital, and Richmond Home for the Elderly. First Aid Kits for the shelters were purchased and distributed.

PAHO also distributed various hospital supplies received from OFDA including generators, mattresses and gas lamps.

Water and Sanitation Activities

Initially, there was a complete lack of drinking water, causing panic among the population. Bottled water from neighboring countries started to arrive in huge quantities, so much so, that in the end disposal of the empty plastic bottles became a problem.

Most of the public drains in St. George's were full of debris and mosquitoes started to breed in the stagnant water. Open water containers used in the households were full of Aedes Egypte larvae which could potentially cause an outbreaks of dengue.

A vector control expert from PAHO's office in Guyana was deployed to Grenada to assist the Ministry of Health to become more operational, conduct entomological surveillance, and take the necessary measure for vector and rodent control.

Private contractors in close cooperation with OXFAM and Solid Waste Management Company of Grenada were identified to clear the drainages and to carry out community projects for solid waste management.

Direct assistance was provided to NAWASA (National Agency for Water and Sanitation of Grenada) for the water quality laboratory in the form of equipment and reagents.

As most of the Ministry of Health staff were personally affected by the disaster, vector control staff, sanitary engineers and other experts from the Eastern Caribbean and Trinidad were brought into Grenada to assist with their activities.

Epidemiological Surveillance

With the assistance of epidemiologists from the Caribbean Epidemiology Center (CAREC), a surveillance system was established in a simplified form so that it could be used in all the official and non official shelters. It was flexible enough to detect outbreaks. (Attachment II CAREC report).

Although few cases of diarrhea in the shelters were reported, no significant epidemics occurred.

Emergency Rehabilitation of Health Services

During the acute emergency, generators were purchased for the main health facilities, as well as, basic supplies such as mattresses and linen. Additional generators were received from OFDA and were also distributed.

With assistance from other agencies, such as Guyana Defense Force (see report from newspaper Attachment III) , Martinique Firefighters, SAMU and Venezuelan Contingent, plastic

sheeting was quickly put over the roof of the Princess Alice Hospital, the Richmond House for the Elderly, several clinics, as well as over the laboratory of the General Hospital.

Materials were purchased for the repairs of the Richmond Home for the Elderly and the hospital laundry. Both buildings had lost their entire roofs, and were regularly flooded causing distress to the patients. The plastic sheeting lasted only a few weeks, as there were no proper rafters or beams to anchor it properly. At the request of PAHO, labor was provided by the Guyana Defense Force.

The central medical store building had to be rehabilitated as a matter of urgency in order to be able to store the arriving relief supplies and vaccines.

A detailed assessment of damages and repairs needed to rehabilitate the health system was carried out by a PAHO consultant (attachment IV). This assessment enabled the government of Grenada to put a price tag on the repairs needed for each health facility including additional mitigation measures to create a resilient building against future hurricanes.

The return of health staff to their place of work was delayed, and thus a medical relief staff of people such as nurses and doctors from neighbouring islands, was brought in. The regional solidarity was impressive and some times overwhelming.

Approximately two months after the hurricane, access to health services had been restored, essential health facilities, with the exception of the laboratory of the General Hospital, started to function and local staff returned to work.

Proper reconstruction of Princess Alice Hospital and other damaged facilities did not yet start, due to prolonged negotiations of the Government of Grenada with International Financial Institutions, and the delay in establishing a national agency for reconstruction to prioritize and manage projects.

Jamaica

Almost all of the population of Jamaica was affected by Hurricane Ivan and about 19,000 people had to be moved to one of the 358 shelters across the country because their homes were damaged (88 communities were severely affected by flooding with extensive damages to roofs). According to the Government of Jamaica there were 11 casualties.

Services were disrupted, but more importantly, septic tanks and pit latrines were flooded. This caused contamination of the wells used by residents for drinking water. The sewer systems were

flooded in the most heavily affected areas. There was a lack of equipment, supplies, and mechanisms to monitor the water quality.

Of the 343 health centres island wide, 124 (36%) suffered some amount of structural damage, mainly roof damages, leaks, and broken windowpanes. Of the 124 centres only 26 (7%) were not functioning due to severe structural damage, lack of essential utilities or no road access, mainly those located in Clarendon, Manchester and Trelawny. To date, all of health centres are fully operational.

In regards to the hospitals, 21 (91%) suffered some structural damage mainly to the roofs of various sections of the buildings. However, only 8 (35%) were not able to provide full service due to limited elective surgery space, insufficient water, and dysfunctional air conditioning units in the operating theaters. It seems that hospital problems were linked more to maintenance issues than to the actual strength of the hurricane, where existing problems were exacerbated because of the storm. It is important to point out that the Kingston Public Hospital (KPH) and the Victoria Jubilee Hospital in Kingston were both without electricity for some time. Together, these hospitals had approximately 600 in-patients. KPH cares for critically ill patients and the Victoria Jubilee caters exclusively for pre and postnatal women. The Cornwall Regional Hospital in Montego Bay appeared to have emerged with relatively little damage, although the kitchen was reported flattened during the hurricane. Falmouth Hospital, Annotto Bay, Spanish Town, Black River, and University Hospitals were providing limited services due to problems with space, limited surgery, water, and the limited work capacity of generators. To date all services have been restored and hospitals are working at full capacity once again.

After phasing problems with electricity, the National Public Health Laboratory services have been fully restored and there are adequate reagents in stock. Also, the Blood Bank is fully functional, after the generator was replaced and able to ensure a continued electricity supply.

Coordination

A PAHO disaster response team was deployed in the days leading up to the hit of Hurricane Ivan to facilitate the assessment of damages caused by the storm. This team consisted of experts on public health, disaster preparedness, biomedical engineers, disease prevention and control, an on the quality of water. The team coordinated their efforts with the UNDAC group that was deployed as well. Both teams worked in collaboration with their corresponding line Ministries, which in the case of PAHO, the Ministry of Health and ODEP were the main counterparts.

Interagency meetings were held at the Office of Disaster and Emergency Preparedness and UNDP. The UNDP meetings were mainly attended by most international agencies that were providing technical, logistic and supply assistance to Jamaica. The meetings purposes were:

1. To open a forum for international agencies to report on the activities they were conducting in the countries.

2. To coordinate efforts with other international agencies in order to avoid duplication of efforts, and maximize resources and efforts.

3. To obtain briefings from the ODEP representatives regarding the level of damages, type of assistance needed, and to coordinate government efforts with the international community.

Two days after the storm, a SUMA team, consisting of experts from St. Lucia and Colombia, was deployed to conduct training on SUMA and provide technical support to the Ministries of Health, Finance and Planning, and the Ministry of National Security to operationalize the SUMA database. The team installed the System at the airport, sea port, and government warehouse facilities. Some local staff already trained in SUMA were immediately recruited. New volunteers were trained.

Logistics and communications were very difficult at the beginning of the operation due to difficulties in the flow of information and road damage or blockage. The airport was inaccessible for three days after Hurricane Ivan as well.

Provision of Medical Supplies and Equipment

Medical supplies (such as antibiotics and basic drugs) in the hospitals, clinics, central medical stores as well as the equipment in the laboratories were damaged.

PAHO purchased emergency and relief supplies to replace loses in health centres/pharmacies and hospitals, which included antibiotics, analgesics, IV fluids, IV equipment, and other basic drugs, as well as laboratory equipment in order to strengthen the medical service facilities of each of the four Health Regions of Jamaica. All of these materials were purchased and distributed in collaboration with the Ministry of Health.

Water and Sanitation Activities

Initially, there was a severe lack of drinking water, causing concern among the population. Bottled water from private water plants and international assistance arrived in huge quantities. However, due to distance and road conditions, the distribution of bottle water took more time than expected. Also, because of lack of coordination between international donors, some communities (usually those close to Kingston) got huge amounts of water from several donors. As a result of the UN and UNDAC coordination of meetings, it was possible to minimize duplication of these areas. CIDA, USAID,

CODAJ, ODEP, PAHO and Red Cross collaborated in efforts to make water available throughout the country.

In some open water containers used in households, Aedes Egypte larvae were detected, creating some concern, since they can potentially cause an outbreak of dengue.

A vector control expert from PAHO's Caribbean Epidemiology Center (CAREC) in Trinidad was deployed to Jamaica to assist the Ministry of Health in becoming more operational, conducting entomological surveillance, and take the necessary measures for vector and rodent control.

Water quality was suspected to be poor and remains one of the main health concerns. Because of this, direct technical cooperation was provided to the Department of Environmental Health of the Ministry of Health, and to the National Water Authority for drinking water assessment and quality control, and assessment of strategies to restore services in the shortest possible time. Equipment and water containers were provided.

Epidemiological Surveillance

With the assistance of epidemiologists from PAHO's Headquarters, the Caribbean Epidemiology Center (CAREC), and the CDC, efforts were made to provide support for the strengthening of the surveillance system to detect and control outbreaks. Outbreak surveillance efforts included training of public health official in identifying and responding to outbreaks.

Due to existing environmental conditions and the disruption of public health services, the potential for outbreaks was high; therefore, control measures were taken rapidly. Water and vector control borne diseases such as dengue, malaria, cholera and gastro-enteritis were possible.

Post Hurricane Ivan (September 2004 to February 2005) there were 23 reported diarrhea outbreaks compared to 8 outbreaks reported between January 1 to August 30, 2004, this number represents a 283% increase. Currently, as per the Weekly Epidemiology Bulletin, gastroenteritis disease is under endemic levels. After the hurricane, the number of gastroenteritis increased significantly in the under 5-age group. The level has since returned to endemic levels. It is important to point out that in 2003 there was a gastroenteritis outbreak.

According to laboratory reports, salmonella has been implicated in six outbreaks in the Western Region. 65.2% of all outbreaks occurred in the Western Region. Due to the devastation of the poultry industry by the hurricane, there was a need to import eggs and poultry products, which may have contributed to some outbreaks.

As a result of the outbreaks, the National Water Authority increased its efforts to chlorinate water, improve the piped potable water distribution to alleviate the water storage in those communities without access to water. In addition the Minister of Health made a public broadcast and developed brochures advising the population to boil water and/or chlorinate it. These materials contain detailed information on the procedures that followed.

Emergency Rehabilitation of Health Services

During the acute emergency, through the support of several international organizations, several generators were purchased to make the main health facilities, as well as water tanks operational. These generators helped restore emergency and routing health services in those hospitals and community centers without electricity. In some centers support was given to purchase gasoline to make generators operational.

Because the central blood laboratory building generator was not properly functioning immediately after the hurricane, and because a considerable amount of blood was lost, arrangements were made to relocate blood to other facilities and to restore services as soon as possible.

A detailed assessment of damages and repairs needed to rehabilitate the health system was carried out by the Ministry of Health. This assessment enabled the government of Jamaica to estimate damages and the cost to replace or repair damaged parts as needed, as well as to determine the amount of medical supplies needed to allow hospital and centers to remain operational. With this list of needs, PAHO mobilized resources from its own resources as well as other international agency sources that were made available through donations and grants to support the operation of health care facilities. Full access to health care services had been restored in most the parishes two months after the hurricane.

Conclusion

The 2004 hurricane season can be seen as a challenge to the countries of the Caribbean, regional and international agencies, as no one was sufficiently prepared for so many hurricanes affecting so many countries in such a short period of time. However, donor countries responded in a timely manner providing sufficient funds during the acute face.

Among the lessons learned are the need to improve regional coordination and relief efforts and the realization that even with the best preparedness measures in place, a certain degree of vulnerability is inherent, and some disasters can cause such overwhelming damage that affect the whole country as well as the entire population.

PAHO in cooperation with CDERA is reviewing the regional response mechanism as well as the contingency plans for the health sector in the affected countries.

PAHO/WHO
Rapid Needs Assessment
Sunday, 12 September 2004

1. Country: Grenada

2. Event: Hurricane Ivan, Tuesday 7 September 2004

3. General Situation: Hurricane Ivan impacted the island of Grenada between approximately 1300hrs and 2000hrs on 7 September 2004 as a Category 3 Hurricane with sustained winds around 125mph. Significant damage was caused to an estimated 90% of the buildings and many persons have lost their homes. 37 confirmed deaths including two foreign nationals and over 300 injuries are known. It is estimated that 4-5,000 persons are being accommodated in approximately 37 official and 61 unofficial shelters (total 98). The temporary accommodation of the National Emergency Operations Centre (EOC) was destroyed during the storm, as were the official residences of the Governor-General and the Prime Minister. The EOC was reestablished in its previous (permanent) location by the end of Wednesday 8 September 2004 but did not become fully operational until about Friday.

Immediately after the storm, electricity and water systems were down. Water has been restored in some areas of Saint George's and electricity may be restored to priority buildings in the next day or so. Many telephones and some cell phone networks are down making communication very difficult. Most main roads are being cleared and are passable but travel on the roads was for a time difficult and time consuming due to the amount of traffic. The Government declared a State of Emergency on the morning of Sunday 12 September 2004 effectively clearing the streets. Gasoline is not generally available and long lines form near the gas stations that are open. The Point Salines Airport has opened to commercial traffic from Saturday 11 September 2004 with limited services and relief supplies are coming in through there and the Port in Saint George's. Most of the tourists who were stranded in badly damaged hotels and the students of Saint George's University have been evacuated.

4. Health situation:

4.1 General: the daily number of injuries seen at the Hospital and the number of deaths have stabilised and fallen however with the breakdown of water and sanitation systems there is potential for the outbreaks of communicable and vector borne diseases. On Saturday 11 September 2004 a total of 33 persons suffering from communicable diseases were seen at the Hospital and increase from 9 the previous

day and 1 the day before. Of the 33, 22 were diagnosed with fever/cough, 8 with gastroenteritis and diarrheal diseases, 2 with fever and rash and one with fever. CAREC is assisting the Ministry to monitor conditions in the shelters and is also tracking whether persons presenting at the Hospital are from shelters.

4.2 Hospital Services: the main Hospital in Saint George's suffered minor roof and window damage but is operational with the same number of beds (192). However the Laboratory lost much of its roof and all the equipment including the Blood Bank is damaged probably beyond repair. There is a need to establish a temporary Laboratory pending construction of the new Laboratory as part of the ongoing redevelopment programme. The Hospital is working with electricity from a standby generator and an emergency water supply. The Hospital kitchen was flooded and makeshift meals are being provided.

Saint George's Hospital Urgent Needs:

Medical Oxygen
Antibiotics
Analgesics
Pain killers
Tetanus Toxoid
Other essential drugs
Disposable; gowns
sheets
gloves
bed linen
Sterile dressing packs
Sterile delivery packs

Basic Laboratory Equipment:
Blood Gas Analyser
Chemistry Analyser
Binocular Microscope
Laboratory Autoclave

Blood Bank Equipment

The Princess Alice Hospital in Grenville in the North East of the island lost 75% of its roof reducing its bed capacity from 56 to 19. Included in the damaged section were the Female Ward, Maternity Unit, Pediatrics and Physiotherapy. The Laboratory and Radiology Departments were also damaged. The staff have carried out temporary repairs and are intending to consolidate the services in the part of the Hospital that was relatively undamaged. It is planned that a French (Martinique) medical team (doctor

and nurse with medical supplies) will be based at the Hospital for approximately 3 days from Monday 13 September 2004.

The Richmond Home for the Elderly was severely damaged and one person was killed when the roof collapsed. The Mount Gay Mental Hospital had only minor damage

Princess Alice Hospital Urgent Needs:

2 Infant Incubators

Basic Laboratory Equipment:
Blood Gas Analyser
Chemistry Analyser
Binocular Microscope
Autoclave

Work top steriliser

Water Tank

Mount Gay Mental Hospital

Generator
Psychotropic Drugs

Richmond Home for the Elderly

Generator
Anti diarrheal drugs
Disposable Diapers

4.3 Community Services

On Sunday 12 September 2004, the Medical Centres and Stations had not yet reopened. Of approximately 6-7 seen during other visits only two seemed to have suffered significant damage. However all will have been without electricity for this period and will continue to be so making reestablishment of the cold chain for vaccines difficult in the short term.

Support to the shelters by community health staff has been variable partly due to the high percentage of unofficial facilities.

A full assessment of the community services and establishment of surveillance through the medical centres and stations will be possible when the services resume.

Urgent Needs

50 First Aid/Medical Kits for shelters

4.4 Water and Sanitation

Water quality remains a concern with persons accessing alternative supplies from, rivers etc. Lack of public radio has restricted the ability of the Ministry of Health to broadcast health and other messages.

On Saturday 11th September 2004, the Grenada Solid Waste Management Company began collecting garbage beginning in the Saint George's area. At this time they are not addressing hurricane debris and a site or sites still have to be identified to dispose of this. A system needs to be developed working in conjunction with the Ministry of Works and the Division responsible for drainage to clear roads and main drains.

4.5 Vector Control: this becomes an increasing concern particularly as garbage and other debris awaits collection and becomes a health hazard.

Urgent Needs

Rat poison
Larvicide and insecticide
Spraying equipment
Water testing kits

4.6 Food Safety: due to lack of water and electricity the Ministry of Health need to check on food storage and shops to ensure the prevention of food borne diseases and leptospirosis..

Urgent Needs

Black lights
Food thermometers
Waterproof flashlights.

For general use:

5 handheld GPS Monitors
1 Digital camera
15 100ft Tapes
Trash bags

PAHO/WHO
12 September 2004

CAREC DUTY TRAVEL REPORT

NAME: Mr. James Flint
Dr. Eldonna Boisson
Dr. Robert Lee

CAREC PROGRAM: Epid

DATE: September 10-21, 2004

PLACE: Grenada

Distribution: ***(Check where appropriate)***
Director CAREC: …√..…. CPC OFFICE: …√…… D/HCP OFFICE: …√…
CAREC Senior Staff: …√… PWR OFFICE: …….. HDA: ……..
CAREC library: …√… Other (Specific): … √… …

Other:
Ms. Gemma Bain-Thomas – Permanent Secretary, Ministry of Health and the Environment
Dr. Alister Antoine – National Epidemiologist, Ministry of Health and the Environment

Purpose(s) of Travel:
To join the PAHO disaster response team in Grenada following hurricane Ivan to assist the Ministry of Heath in:

1. Conducting rapid needs assessments of health centres, medical stations, hospitals and shelters
2. Developing and maintaining databases of the status of health centres, medical stations, hospitals and shelters
3. Strengthening and expanding syndromic surveillance and disease control in the public health institutions
4. Monitoring injuries and deaths
5. Establishing post disaster surveillance in Shelters

Key Individuals ***(including those visited and significant co-travellers):***
Ministry of Health and the Environment (MoH&E)

Dr. Keith Mitchell	Prime Minister
Ms. Ann David-Antoine	Minister of Health
Dr. Clarice Modeste-Curwen	Minister of Communication and Works
Ms. Gemma Bain-Thomas	Permanent Secretary
Dr. Alister Antoine	National Epidemiologist
Dr. Bert Bradwaite	Chief Medical Officer (Ag)
Ms. Mildred Cruickshank	EPI Manager/Senior Community Health Nurse

St. George's General Hospital

Dr. Sonia Phillip	Accident & Emergency Physician
Ms. Ruth Penny	Infection Control Nurse

PAHO Disaster Response Team

Dr. Dana Van Alpen	Team Co-ordinator, PAHO-HQ
Mr. David Taylor	Health Systems, CPC
Ms. Avril Suing Chang	Environmental Health Officer, PAHO-TNT
Ms. Veta Brown	Caribbean Programme Coordinator, CPC
Eng. Hugo Martinez	Medical Engineer, CPC
Mr. Steven De Vriendt	Disaster Response, PAHO, Nicaragua
Mr. William Erdel	Chief of Procurement, PAHO-HQ
Nr. Patricia Hanley	Community Health Nurse, Ministry of Health, BVI
Dr. Edward Sagala	Ministry of Health, BVI

Several members of the National Emergency Response Operations (NERO) team

Summary of Trip:

1. Background

Hurricane Ivan passed over Grenada on Tuesday September 7, causing extensive infrastructural and housing damage; disrupting electricity, water supply, communication and road access. Building damages have initially been estimated to be 85-90% throughout the island. During the first few days following the hurricane, transportation was severely hampered by debris blocking the roads, shortage of fuel and traffic jams throughout St Georges and surrounding area. As of September 20, the regular electricity supply was still unavailable in most of the island; water from the mains had been restored to many areas; regular phone connections had been restored in a few areas and many people had access to cell phones; and almost all roads had been cleared of debris. Previously lush rainforests are now brown, with most of the trees and plants either uprooted or stripped of leaves and branches.

The south of the island was the worst affected, in particular the parishes of St. Georges, St. Davids and St. Andrews. As one moves North, conditions improve, with the most northern parish (St. Patricks) having hardly any damage.

Immediately following the hurricane widespread looting took place. Subsequently, a 6pm-6am curfew was declared on Thursday September 9, and a state of emergency was declared for one day on September 12.

Many staff working in the health sector suffered personal losses, including sever damage to their homes. Consequently, there was a severe staff shortage immediately following the hurricane. The situation in this regard is improving, but as of September 20, some staff were still unable to function.

2. CAREC Team Activities

Two CAREC epidemiologists were stationed in Grenada during the period September 10-21, who in collaboration with the PAHO disaster response team, the Ministry of Health and other International Agencies conducted the following activities:

- Rapid assessment of approximately 40 shelters in Grenada to determine infrastructural damage, water supply and storage, food supply, medical needs and the communicable disease situation.
- Rapid assessment and follow-up visits to all (5) health centres in Grenada to determine infrastructural and equipment damage, availability of medications and other medical supplies, water supply and storage, food supply, and the communicable disease situation.
- Rapid assessments of all (26) medical stations in Grenada (and follow-up visits to some) to determine infrastructural and equipment damage, availability of medications and other medical supplies, water supply and storage, food supply and the communicable disease situation.
- Establishment of daily syndromic surveillance in the St Georges Hospital Casualty Department.
- Initiation of syndromic surveillance at the 5 health centres in Grenada, with each centre coordinating surveillance in the medical stations in their district.
- Developing and maintaining databases of the situation and needs of the health centres, medical stations and shelters. Daily updates of these databases were provided to the Ministry of Health, NERO and several international agencies in the Emergency Operating Centre.
- Developing and maintaining a surveillance database of communicable diseases and other illnesses registered in the public hospitals.
- Recording of numbers of injuries and deaths following the Hurricane.
- Writing press-releases for the Ministry of Health.
- Writing health education messages for dissemination via PA systems and for inclusion in NERO's bulletin for shelters and community centres.
- Attending debriefing meetings with the NERO, Minister of Health and PAHO teams.

3. Injuries and Deaths

During the period September 8-19, a total of 615 injuries were registered at the St. Georges General Hospital Casualty Department. An additional 51 injuries were registered at Princess Alice Hospital during September 12-16. St. Georges General Hospital Casualty Department also registered 142 admissions during the period September 8-19.

There were 37 deaths recorded during the period September 7-11, of which 28 were due to incidents related to the hurricane.

4. Situation in the Public Health Institutions

There are 2 public hospitals in Grenada and 1 in Carriacou.

Princess Royal Hospital in Carriacou sustained minimal damage and services were not interrupted.

The St. Georges General Hospital sustained minor damage and was functioning the day after the hurricane passed. The Hospital Laboratory was damaged and a temporary laboratory established in the X-Ray Department. Electricity was powered by a generator

until September 15, when the regular electricity was restored. Running water and medical supplies are available.

The Princess Alice district hospital in Grenville was severely damaged and roofing and other materials and mattresses were stolen. The only section without severe damage was the male ward, which following some repairs was able to function as a clinic. The ambulance service was uninterrupted following the hurricane. All patients in the hospital prior to the hurricane were either discharged or transferred to St Georges Hospital.

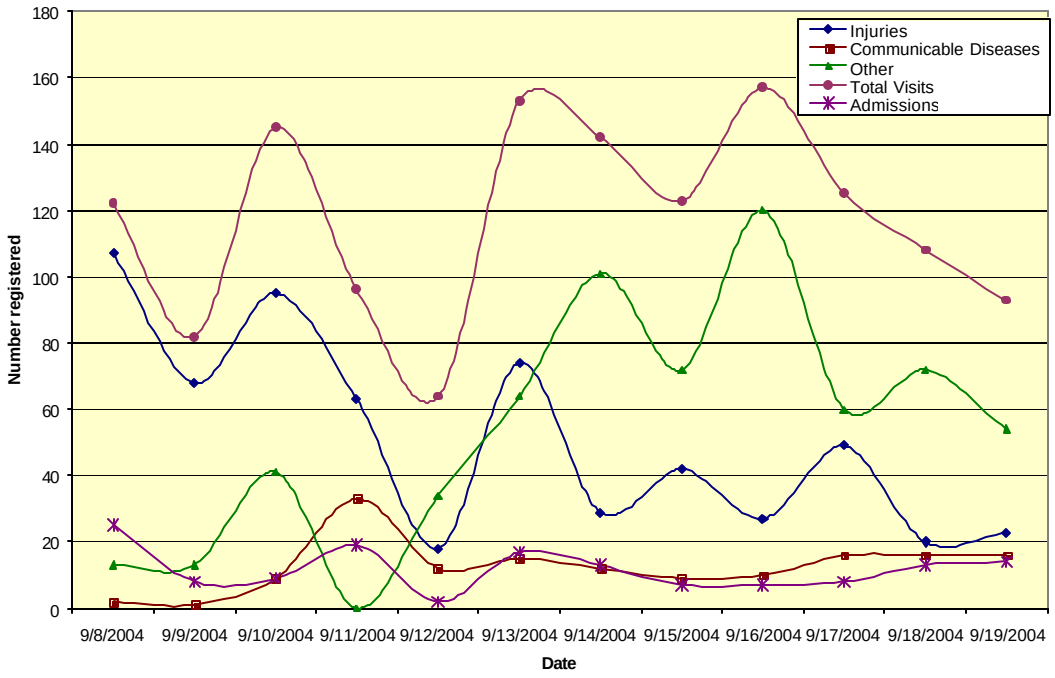
There are 5 Health Centres and 26 Medical Stations in Grenada, and 1 Health Centre and 4 Medical Stations in Carriacou. The facilities in Carriacou sustained minimal damage and services were not interrupted. In Grenada, the level of damage varied, with the institutions in the South generally being more affected than those in the North. As of September 16, all Health Centres and many Medical Stations were open and functioning. Appendix 1 gives the status and needs of each facility.

5. Hospital syndromic and injury surveillance

Appendix 2 gives the daily syndromic and injury surveillance for St. Georges and Princess Alice Hospitals.

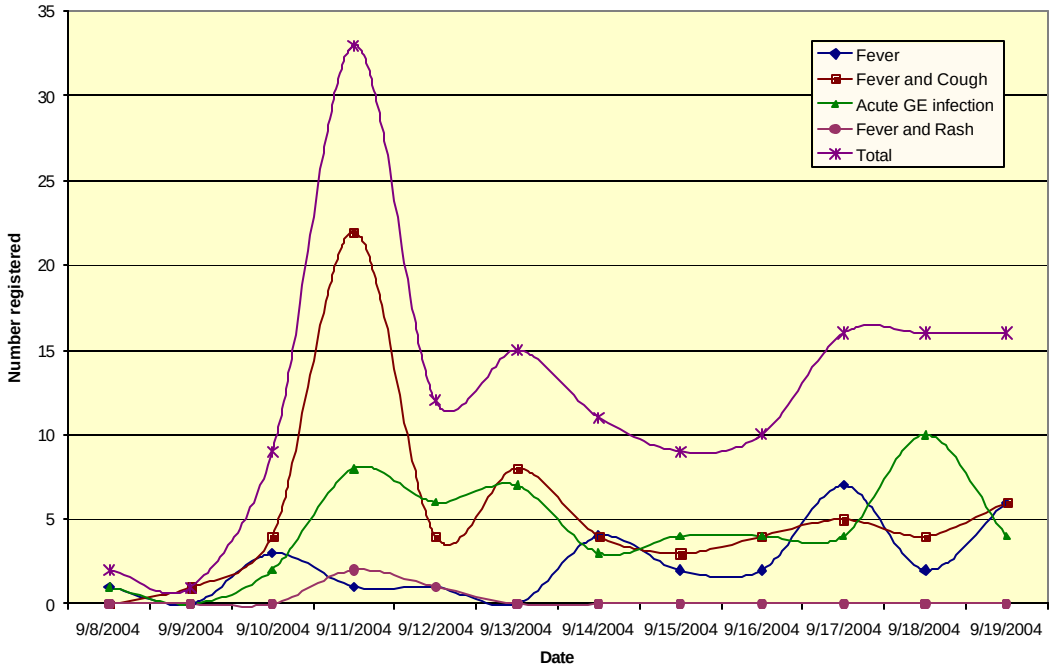
During September 8-19, St. Georges Hospital casualty department registered 1,443 visits of which 142 were admitted, 615 persons with injuries and 151 persons with communicable diseases [Figure 1]. Total visits varied during the period, the number of persons with injuries is generally declining and the number of persons in the 'Other' category (consisted mostly of persons presenting with stale dressings and old infections) is increasing. The number of persons presenting with communicable diseases or being admitted remained low [Figure 1].

Figure 1 - Patient visits to registered at St. Georges Hospital Casuality Department



Most of the 151 persons with communicable diseases had fever and cough (65 persons), 53 had acute gastrointestinal illness, 29 had fever alone, 3 had fever and rash and 1 had an STI [Figure 2]. The number of persons presenting with fever and cough peaked on September 11 and the number with acute gastrointestinal infections peaked during September 11-13 [Figure 2].

Figure 2 - Communicable diseases registered at St. Georges Hospital Casuality Department



An attempt was made to establish a surveillance system in the wards of St. Georges Hospital. However, data collection only occurred on September 13, and has not been available since then.

During September 8-16, Princess Alice Hospital registered 65 visits of which 51 persons had injuries and 7 persons had communicable diseases.

6. Shelter Situation

As of September 20, 150 shelters with a total population of 5,753 persons were identified. In this report a shelter is defined as:

- An official primary and secondary shelter as designated by NERO
- All identified places (official and unofficial) housing 20 or more persons
- All identified institutions, churches, schools and community centres reported to be housing persons

Many of the 37 officially designated shelters were severely damaged and were not able to be used as shelters. It is assumed that the larger shelters will need to remain open for at least 2-3 months. Table 1 shows the shelters by parish and number of persons housed in each shelter. The largest proportion of shelters (79 of 150) house between 20-100 persons, 3 house more than 200 persons, 11 house between 100-199 persons and 57 have either less than 20 persons or no information is available on them. St. Georges has the largest number of shelters (59), followed by St. Andrews with 40, then St. Davids with 28. St. Patricks, St. Johns and St. Marks have few shelters - 23 in total. The distribution of shelters is largely a reflection of the extent of damage caused by the hurricane and the

population size in each parish, with St. Georges (most South) being the most affected and St. Patricks (most North) being the least.

Table 1 – Shelters by parish and number of persons housed

	Number of persons						
Parish	**>200**	**100-199**	**50-99**	**20-49**	**<20**	**No info**	**Total**
St. Andrews	1	0	2	13	14	10	40
St. Davids	2	4	6	13	1	2	28
St. Georges	0	6	14	21	9	9	59
St. Patricks	0	0	0	5	2	5	12
St. Johns/St. Marks	0	1	3	2	3	2	11
Total	3	11	25	54	29	28	150

Appendix 3 gives a breakdown the situation in each shelter with respect to numbers of persons housed, contact information, type of shelter, food and water supply, date of last visit and infrastructural damage.

7. Conclusions and Recommendations

1. Hurricane Ivan has severely affected Grenada. The lifestyle of the people of this country has been radically changed and there is a major impact on the economy of the country. These changes are likely to persist for several months and full recovery to conditions pre-Ivan is likely to take several years.
2. As of September 20, surveillance data did not show any unusual health trends, apart from an increase in injuries. However, current conditions could easily facilitate an increase in many different health problems, such as communicable diseases (e.g. gastroenteritis, dengue fever), injuries and social problems. Additionally, persons with chronic diseases (such as diabetes and hypertension) could experience worsening health conditions if they are unable to get their medications.
3. All Health Centres should be visited or contacted weekly to determine medication and supply needs. This information should be requested from the Health Centres and reported to Central Medical Stores. Medications and supplies requested should be delivered to the Health Centre within 2 days following the request.
4. The Ministry of Health has started and must continue to take control of surveillance activities and expand this effort to the entire system.
5. Surveillance of communicable diseases should be focussed in the public hospitals, health centres and medical stations as follows:
    a) Daily active surveillance established in the St Georges Casualty Department and Princess Alice Hospital needs to be continued using the data collection form in Appendix 4. The hospital infection control nurse should be responsible for collecting this surveillance data and a system should also be established to ensure that this data is collected in her absence. The office of the National Epidemiologist should collect this information from the infection control nurse on a daily basis.
    b) Daily active surveillance needs to be expanded to the wards in St. Georges Hospital and to Princess Royal in Carriacou using the data

collection form in Appendix 4. A system for data collection and reporting needs to be established as described above in 5a).

c) Daily syndromic surveillance initiated at the health centres needs to be maintained, with each health centre coordinating surveillance activities in the medical stations in their district. The nurse in charge at each health centre should be responsible for collecting this data from each medical station in the district and a system should also be established to ensure that this data is collected in her absence. The office of the National Epidemiologist should collect this information from the nurse in charge. This data should be reported on the data collection form in appendix 4.

d) All surveillance reports should be at the office of the Epidemiologist by 12 noon the following day.

e) The Ministry of Health should identify a person(s) to maintain and update the surveillance databases daily, or at the very least every two days.

6. Grand Bras, St. Davids and Gouyave Health Centres should be equipped with generators and subsequently the EPI manager should be responsible for the following:
    a) Refrigerators should be checked and a temperature monitoring system should be established.
    b) Vaccines and other supplies requiring refrigeration (Tetanus vaccines and insulin are priorities) should be distributed as soon as cold chain has been established.
    c) Cold boxes should be distributed for supplying medical stations.
7. As many medical stations as possible should be restored and reopened as soon as possible.
8. Priority shelters listed in Appendix 3 should continue to be monitored:
    a) The Ministry of Health should identify a person(s) to maintain and update the shelter database (can be the same person(s) identified for the surveillance database).
    b) Shelters that have not yet been visited should be visited as soon as possible and information collected to update the database so that it can be used to better prioritize relief activities.
    c) Priority shelters (listed in Appendix 3) housing 50 or more persons should be visited on Mondays, Wednesdays and Fridays. During these visits two sets of data should be collected: 1.Syndromic surveillance of communicable diseases using the data collection form in Appendix 4. 2. Information on general conditions, environmental conditions, unusual events (e.g. incidents of violence or disease outbreaks) and urgent needs – using the data collection form in Appendix 5.
    d) All shelters listed housing less than 50 persons should be visited on Tuesdays and Thursdays to collect information on general conditions, environmental conditions, unusual events (e.g. incidents of violence or disease outbreaks) and urgent needs – using the data collection form in Appendix 5.

e) The existing community health teams (community nurses, environmental health officers, etc) for each parish should be responsible for visiting the shelters as outlined in 8 c) and d). RSS army medics should join the community health teams in the parishes with the largest number shelters, namely, St. Georges, St. Andrews and St. Davids. This should continue until the numbers of shelters in these parishes are small enough for the regular community health teams to manage.

f) The database of shelters should be maintained by the office of the National Epidemiologist and daily updates should be made available by 10am the following morning to the Permanent Secretary of the Ministry of Health, the NERO shelter manager and other organizations in need of the information.

9. The office of the National Epidemiologist should be equipped with a mobile phone, so that hospitals and shelters can immediately report any unusual disease events that may occur during a weekend.
10. Health education messages aimed at preventing the spread of communicable diseases and the occurrence of injuries should be disseminated regularly by any available means, e.g. radio, PA systems in communities, NERO bulletins, face to face interactions and meetings. The Health Promotion Department of the Ministry of Health should be responsible for these activities.
11. During the period September 21-27, assistance will be provided to the Office of the National Epidemiologist as follows:
    a) An experienced volunteer state epidemiologist from New York, Dr. Oscar Alleyne, (Grenadian national) will assist in gathering surveillance data from the hospitals and health centres and will require transportation for this activity. He will also assist in maintaining and updating the syndromic surveillance and shelter databases.
    b) A volunteer MPH graduate of St. Georges University, Ms. Tonya Frame, (Grenadian national) will assist in updating the syndromic surveillance and shelter databases and producing the daily updates.
    c) A CAREC epidemiologist (Dr. Robert Cazal) during September 22-24.
    d) The above three volunteers will work with existing staff – Dr. Alister Antoine, Nr, Agnes Banfield and Dr. Omar Guerra.
    e) Databases should temporarily be housed on Dr. Alleyne's laptop, while the Ministry of Health sets up office. By September 24, the databases should be transferred to a computer in the office of the National Epidemiologist. Databases should be backed-up daily onto an external disk, CD or flash stick.
12. A CAREC epidemiologist should continue to liaise with the Ministry of Health and visit on September 27-28 to monitor progress with the development of the surveillance system and assist with plans for sustaining it. Subsequently, if required, further visits will be made periodically to support surveillance activities.

_____ _____

Mr. James Flint Date
Epidemiologist, Epidemiology Division

_____ _____

Dr. Eldonna Boisson Date
Manager, Epidemiology Division

_____ _____

Dr. Robert Lee Date
Epidemiologist, Epidemiology Division

ANNEX III

Article from Stabroek News in Guyana highlights support from PAHO.

Guyanese soldiers give all to Grenada reconstruction

By Miranda La Rose
Tuesday, May 31st 2005

Contingent Commander, Lt Col Bruce Lovell (second from right) with Colonel Chabilall Ramsarup (second from left) and a Grenadian Prison official inspecting works at the Her Majesty's Royal Prisons. (Photo courtesy of the Guyana Defence Force

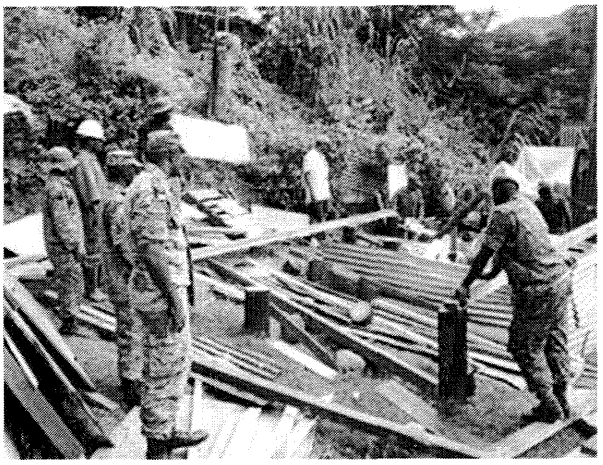
When the batch of 100 Guyana Defence Force (GDF) soldiers left Guyana for Grenada as part of the government's assistance in the recovery and reconstruction plan after Hurricane Ivan ravaged the island, none of them knew that Guyana was going to experience its own natural disaster.

Nevertheless, the military operational plan, code named Operation Phoenix, under the command of Lt Colonel Bruce Lovell arrived on the devastated Isle of Spice with an advance party on October 17, followed by the logistical, security and support staff the following day aboard the GDFS Essequibo to set up accommodation in the space allocated to the Regional Security Service Unit (RSSU) adjacent to the Point Salinas Airport. The last group comprising engineers, carpenters and other skilled staff arrived on October 25. The contingent's task was two-fold - reconstruction and security.

The soldiers' assistance to Grenada embraced six sectors - security, housing, health, education, electricity and water - saving the Grenada Government EC$1.2 million in labour costs. They were involved in 15 construction projects. They assisted in food distribution to the aged, schools and homes.

Mission Operation Phoenix lasted in excess of six months. Major Brian Bristol was the second-in-command followed by Logistics Officer, Major Nazrul Hussain. There was one rotation in March, which was pushed back from January after the floods struck Guyana.

Lovell told Stabroek News that when the contingent got to Grenada the security situation had stabilized. "There was no more looting. The curfew was on but we were not required to enforce it. That was done by the RSSU. We concentrated on force protection and provided some back-up patrols at various key points in the city. At all times we worked with the Grenadians."



The Guyanese soldiers preparing to build a home for a single parent family of five in time for Christmas.(Photo courtesy of the Guyana Defence Force)

After the Guyanese arrived on the island, the Trinidad and Tobago soldiers and RSS forces departed. Their departure was marked by a sense of uneasiness among the citizenry, Lovell said, "So in conjunction with the GDF, the Royal Grenadian Police Force mounted an operation designed to assure the populace that the environment was secure and stable."

In that operation, they provided patrols at various key points in the capital, St George's, a week before and a week after Christmas. "We wore helmets like construction workers and partnered the Grenadian police. There was some lack of confidence, as it was alleged that some policemen had been part of the looting that had rocked parts of the country after the hurricane," he said.

The camaraderie among the military units from Guyana, the region and Venezuela was good. The Trinidadians were located at St George's University and the Venezuelans at the stadium. "When we got there the Venezuelans helped us with a 'Bob Cat' [a grader] to do our work. There are 120 Venezuelan soldiers on the island. Right now they are building 130 houses in an area to be named the Simon Bolivar village. They are due to leave at mid-year. At first they did a lot of clean-up work and that has evolved to reconstruction and construction work."

Lovell said initially as administrator, he met various government officials. Projects were identified but they could not get them off the ground as expeditiously as they wanted because of inadequacy of materials. In the interim, he said they got busy putting tarpaulin roofs on schools, hospitals and government agencies in a number of temporary projects they called 'Band Aid' projects, because the rainy season had begun.

The first permanent project they worked on was the Richmond Home for the Aged where they completed the re-roofing, electrical and plumbing works to the building in a month's time and in time for the Christmas. The contingent took on the project when the Pan American Health Organisation (PAHO) Regional Co-ordinator for Disaster responsible for health facilities visited the island. "It was raining at the time and the old people were being shifted around the island. It was a pitiful sight. The co-ordinator made an appeal. On humanitarian grounds I just couldn't refuse that project. PAHO provided all the materials, so the bureaucracy as government agencies had, was not there."

In the health sector, they also re-roofed and installed electrical fittings to the hospital laundry and the St John's Ambulance Brigade building.

Of the 15 construction projects the soldiers worked on with the government, six were in the security sector. The work included the reconstruction of the prison fences; plumbing, electrical works and the re-roofing of the prison, the Central Police Station, the traffic building, St Paul's Police Station, the RSSU Mess Complex, and the Police Commissioner residence.

Very significant, Lovell said, "were the plumbing, the electrical works and the re-roofing of the main cell block for the prison, which accommodated two thirds of the prison population. Because this was out of commission, the more seasoned prisoners had to be sent to St Lucia. The others were accommodated in temporary structures in the prison compound."

They rebuilt three projects "from the ground right up" and three residential homes - two two-bedroom houses and a one-bedroom house. Lovell said the houses were for single-parent families who were in the very vulnerable group. "The men really appreciated working on these projects because they had a chance to see the beneficiaries. They saw the immediate impact of their labour."

They built one of the two-bedroom houses in the week and a half before Christmas. "A Ministry of Social Development official asked us to construct the house for a family of four. The men wanted the female single parent and her children to receive a Christmas gift, so they worked long hours to complete it. The other two-bedroom house we worked on after the Christmas so that the other family could have moved in before the dawn of the New Year," he said.

He said that sometimes individuals "represented their cases and if the work flow permitted it, we helped." The soldiers also re-roofed the home of the former Governor General at the request of the Grenada Government.

In the housing sector, too, the soldiers provided masons and a labour force to the international non-governmental organization (NGO), the Samaritan's Purse. The NGO laid the foundation for a number of homes in Grenada. "They had laid the foundation for 150 homes - 18ft by 14 ft each. They placed tarpaulins around the sides of the homes with the expectation that as the families obtain funds they would remove the tarpaulins and replace them with permanent walls. Our men lifted and transported the pre-fab house frames. The NGO was extremely appreciativeâ€¦," Lovell related.

In the education sector, the soldiers did electrical works and plumbing to two schools, the Grand Roy Government School and the Happy Hill Secondary School where the head is a Guyanese who asked for assistance. They also placed tarpaulin roofs on several others when the heads asked for help.

On arrival in Grenada, the linesmen were the first set of soldiers to be deployed to the electricity company, and the plumbers were attached to the water utility. They completed their assignment a week before they left Grenada.

The assignment, Lovell said, tested the creativity of the soldiers. He said when they started to build the Richmond Home, hurricane straps were not available. "Technician Warrant Officer Class Two Tremblett Holder had to improvise. The construction method we used to tie down the rafters onto the house frames was something he improvised and utilised. The Cuban engineers, who did the quality assurance check on our work were impressed. They wanted to be shown the technique we used. By the last project we had improved on it by using a metal sheet that was sturdier than the small aluminium strap they used."

Lovell said it was a totally different construction method but only a hurricane "would give an indication of how they stand up." Guyana does not use hurricane straps in building construction.

Worthy to note, he said was that six women, including Lance Corporal Avella Wilson, who was a carpenter, were part of the contingent. Grenadians were surprised to see Wilson, a woman, involved in carpentry and the Grenada media interviewed her on a few occasions. Because of the heights she would go, the men would not be outdone and would follow.

"The soldiers worked Monday to Friday, from 07:00 hrs to after 17:00 hrs and up to midday on Saturday. During the week they were not permitted to go out. By the time they finished working in the sun and the elements they were tired. Each tent had some level of comfort including cable television, games and canteen facilities. Saturday afternoons and on Sundays there were organized tours to parts of the island or the men would go to the beaches. Some had relatives they visited but contact was maintained with the base. Even the social aspects of their lives were controlled."

The Guyanese community, he said, "was extremely proud of us. They started to identify with us at every available opportunity. A Grenadian told me, "since you all are here a lot of people are claiming to be Guyanese."

The soldiers lived under camp conditions for their entire stay with all the basic amenities including water and electricity. "We even had internet facilities and that was motivation. Everyday we printed the Stabroek News and the Guyana Chronicle off the websites and circulated among the men to keep them abreast of happenings back home, especially during the flood."

During their stint, they also took part in a number of activities including two national half-marathon races in which 20 soldiers out of 80 competitors took part. Eighteen soldiers were in the first 30 ending the race with one Guyanese placing sixth overall. A platoon of GDF soldiers also took part in Remembrance Day activities along with other Caricom contingents. To keep fit they exercised three days each week.

As the Guyanese contingent became the only Caribbean force on the island and stayed through Christmas, Lovell said, "when the floods came, the Grenadians became nervous. They wanted to know if we were going back home. They were relieved when we stayed on."

The floods affected 53 soldiers directly and others were indirectly affected. "Everyone was in contact with home. The GDF support system sought out relatives of the soldiers and provided assistance where necessary.

Measures were taken to look after the families of soldiers affected. We had a driver from Paradise who lost everything.

His wife told me when she returned home after the floods her home was vandalized. She broke down in tears. With all of that the soldiers' determination in Grenada did not falter. The administrative and logistical support back home was necessary."

Lovell, who was on his first disaster relief mission, leading the largest contingent from Guyana on an overseas mission, said he was extremely proud of the performance of the soldiers, "Who were true ambassadors who truly won the admiration and respect of the Grenadian people".

He felt it was one of his best commanding experiences. Some of the men had prior experience on disaster relief missions including Major Hussain.

The response from the Grenadians served to motivate the men, especially during the floods, Lovell said, adding, "Just about everywhere you go, people said 'thank you for coming'. They opened their arms, hearts and homes to us. This was especially so as our tour of duty was coming to an end and the amount of appreciation functions held in our honour from every

quarter."

An aspect of Grenadian support, he said, ironically was fund-raising efforts for flood relief in Guyana, which was held on the island.

A luncheon hosted by Guyana Consul netted EC$15,000. A group of Guyanese professionals, including Justice Kenneth Benjamin, a Guyanese professor and first black dean at the St George's University held a 'GT after-lunch fete'. "It was massively supported by Grenadians. Prime Minister Keith Mitchell attended the two functions. This was followed by a telethon organised by the Grenada Rotary, which raised US$50,000. Rotarian Dunstan Barrow received the funds at an international function and was moved to tears when he collected it," he noted.

The Grenada Port Authority, too, held a fund-raising activity and the GDF, he said was involved "in a big way. We provided security, manned the different booths and cooked a lot of the food. There was massive outpouring of support, even the school children did their bit," Lovell said. "It was really moving. I felt it was Grenada's way of expressing their appreciation for the work we did."

Pan American Health Organization

Grenada after Hurricane Ivan

Second Interim Report on the Damage to Selected Healthcare Facilities

by
Tony Gibbs
CEP International Ltd

30 September 2004

Acknowledgments

Grenada Government:

Hon Ann David-Antoine – Minister of Health & the Environment
Mrs Gemma Bain-Thomas – Permanent Secretary, Ministry of Health & the Environment

Pan American Health Organisation:

Dr Dana van Alphen – Regional Adviser
Mr David Taylor – Hospital Administrator

Consultants:

Mr Tony Gibbs – Leader and engineer
Miss Kathy H Gibbs – Structural engineer
Mr H A George Fletcher – Grenada coordinator and engineer
Mr Timothy Bubb – Engineer
Mr Michael Samms – Quantity surveyor

Grenada after Ivan
Second Report on the Damage to Selected Healthcare Facilities
by Tony Gibbs, CEP International Ltd

30 September 2004

Introduction

The Event

Hurricane Ivan struck Grenada in the afternoon of Tuesday 07 September 2004. According to the National Hurricane Centre (Miami) the eye of Ivan passed about 10 km south of the airport at Point Salines. According to the National Hurricane Centre the sustained (1-minute) wind speed in the eye wall at that time was 120 mph. The Caribbean Uniform Building Code (CUBiC) prescribes a reference (50-year return period) pressure equivalent to a 1-minute wind speed of 85 mph. Therefore the wind forces due to Ivan in the north eye wall (*ie* the southern part of Grenada) could have been of the order of twice what was envisaged for non-critical facilities by CUBiC. Critical facilities, such as some healthcare facilities, would warrant design forces between 25% and 50% higher than for non-critical facilities.

A mitigating factor was that the hurricane had an unusually fast forward motion so that it did not linger over Grenada. This would have reduced the structural damage. In addition, fast-moving hurricanes deposit less rain on the target area.

Assignment

The Pan American Health Organisation (PAHO) commissioned CEP International Ltd to undertake an assessment of the damage to eleven healthcare facilities in Grenada.

The Brief

A first report estimating the cost of repairs to the facilities was to be presented by 22 September 2004[1] in order to provide information for ECLAC's study for the Government of Grenada and for the UN in Geneva. This was done by means of a very rapid assessment on 21 & 22 September. The summary of the results of that very rapid assessment are in an appendix dated 24 September 2004. (This was a revision of the original document submitted on 22 September 2004.)

This second report on repair costs is aimed at a donor's conference scheduled for early October 2004. It revises the costs on the basis of more detailed examinations and measurements of the facilities

[1] the 49th anniversary of Hurricane Janet in Grenada

which took place from 23 to 30 September 2004. This second report is due for delivery by the end of 30 September 2004.

A third and final report will be prepared with a wider brief including diagnoses of failures, vulnerability assessments and retrofitting recommendations. The third report is to be completed by the end of November 2004.

The Observations

Limitations

In the time available we were able to observe the nature of the damage to the facilities without the benefit of invasive investigations. We were not able to interview all of the custodians of the various facilities. It is expected that this would be achievable during the final phases of the assignment in October and November 2004.

Extent of Damage to Buildings

All of the facilities suffered some damage. None was completely destroyed. The amount of damage varied from 5% to 75% of the individual facilities taken as a whole.

Roofs

Wherever there was damage it was likely to be to the roofs. Almost all of the roofs suffered sufficient damage to impair the efficient functioning of the facilities. In some cases only the roofing (weather covering) was lost. In such cases the buildings would leak profusely whenever there was rainfall. In other cases the roof structure was lost completely or in large measure. In such cases the process of repair would be much more time-consuming and expensive.

Vertical Envelopes

The other envelope components that suffered damage or complete loss were windows and external doors. In some cases even the shutters protecting windows were damaged or removed completely.

Structures

There were some cases where entire structures were destroyed.

Meteorological Context

None of the above should be surprising if we are to accept the wind hazard information provided by the National Hurricane Centre on Ivan. We were unable to obtain any anemometer records in

Grenada. In the absence of such records the National Hurricane Centre is probably our best guide as to the intensity of Ivan.

Anomalies

It is a common observation in great hurricanes that there are some houses which suffer no damage. We saw a few such examples in our inspections. Those examples were unremarkable in shape, materials and other external characteristics. By that we mean that those buildings seemed similar to many others that had been damaged significantly. It would be worthwhile studying those examples much more closely during the remainder of the assignment.

Climate Change

Much controversy surrounds this subject. There is certainly no unanimity among scientists about the extent of global warming and effect of global warming on the weather patterns of this planet.

Increases in Frequency and Intensity of Windstorms

There is a general feeling that windstorms have increased in frequency and severity in recent decades. This "feeling" is unreliable as a measure of the facts. Certainly there has been a dramatic and irrefutable increase in economic losses during the past three decades as compared with earlier decades. But this has more to do with demographics than with the weather. The trend is for population shifts towards coastlines which are more vulnerable to windstorms and for greater concentration of populations in urban areas as opposed to dispersed rural agricultural communities. Also there is the much better reporting of disasters through global television networks. As recently as 1976 an earthquake in Tangshan (China) killed several hundred thousand people and yet went largely unreported for months. Much less cataclysmic events are known of instantly around the world today.

Nevertheless, it is worth examining the possible effects of climate change on the frequency and severity of wind hazards.

The Greenhouse Effect

The main source of energy for our planet is the sun. In spite of the considerable amount of energy provided by the sun (about 20,000 times as much as the total of all man-made power stations on earth) the temperature of the earth would be 30 degrees celsius colder were it not for the blanketing effect of the atmosphere. This is the so-called greenhouse effect. The atmosphere consists mainly (99.9%) of nitrogen, oxygen and argon. The remaining trace gases are mainly water vapour, carbon dioxide, ozone and methane. An important function of these trace gases is to absorb the thermal radiation emitted by the earth and send it back to the earth's surface thus reducing dramatically the

loss of heat. An increase in these greenhouse gases is therefore blamed for global temperature rise. Global temperatures have been measured accurately and reliably for over 100 years. The absolute rise has been quite small (less than 1 degree celsius) during this period. However the rate of rise has increased quite dramatically during the past thirty years, hence the alarm.

Deforestation and Industrialisation

Natural forests covered 35% of the earth's surface as recently as the nineteenth century. Now that figure has been reduced by a third. This has resulted in a significant change in the water and radiation balance of the planet. An even more important development is the use of fossil fuels (coal and oil) for our energy needs. This leads directly to an increase in the carbon dioxide content of the atmosphere. Various models predict a range of temperature rises for the planet. That range is between 1 and 5 degrees celsius over the next sixty years. Two-thirds of this increase is attributable to increases in carbon dioxide and chlorofloro-carbons (CFCs). (CFCs are used as propellants in sprays and in refrigerators and foamed plastics.)

Munich Reinsurance

Dr Gerhard Berz, Head of Munich Re's Geo Risks Research Department, states:

> "We will have to get used to the fact that hot summers like the one we had in Europe this year[2] must be expected more frequently in the future. It is possible that they will have become more or less the norm by the middle of the century. The summer of 2003 was a 'summer of the future', so to speak. For many years we have been warning about the elevated danger of heat waves and the associated problems and risks. Warmer summers mean a rise in the intensity and frequency of severe weather events. A heated-up Mediterranean and a warm North Atlantic increase the risk that particularly strong low-pressure systems will form in autumn and winter with torrential rain and extreme wind speeds. This was confirmed by the devastating floods in southern France at the beginning of December and the intense low-pressure system called Jan over west and central Europe shortly before Christmas."

The quickening pace and diversity of climate change serves only to raise the stakes in this high pressure game.

The Results

Damage Levels

Information on damage levels for the individual buildings within the facilities are summarised in

[2] 2003

Appendix B to this report. These are based on the more detailed assessment of 23 to 30 September.

Repair Costs

The estimates based on the very rapid assessment of 21 & 22 September are presented for completeness in Appendix C.

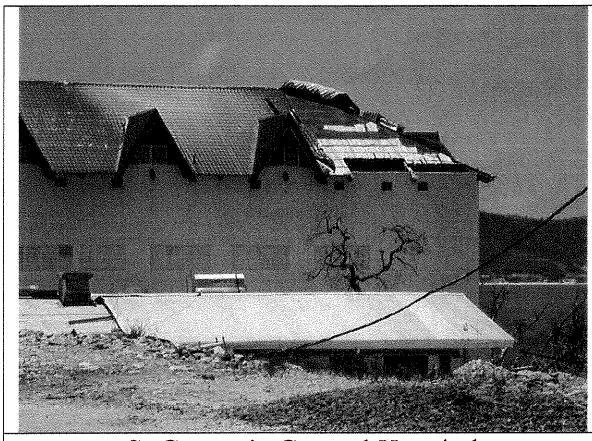
The estimates based on the more detailed assessment of 23 to 30 September are presented in Appendix D. These are the current figures which should be used until the final report is issued towards the end of November 2004. It must be noted that these current figures do not consciously allow for any retrofitting which may be indicated by the vulnerability assessments to be conducted in October and November. In particular, no account has been taken of the earthquake hazard in estimating repair cost at present. This will be done for the final report.

Photographs

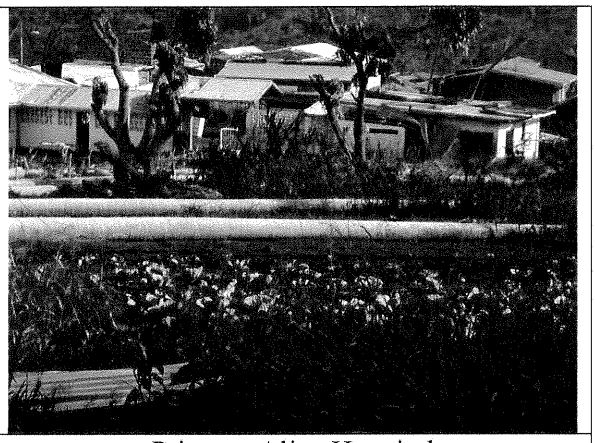
A selection of photographs taken between 09 and 28 September are attached as Appendix A.

Appendix A

Photographs

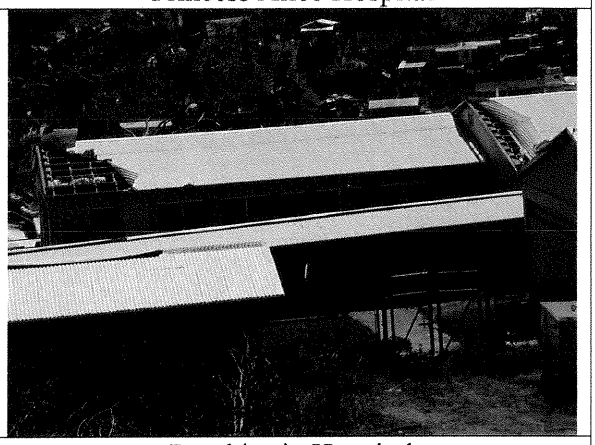


St George's General Hospital



Princess Alice Hospital

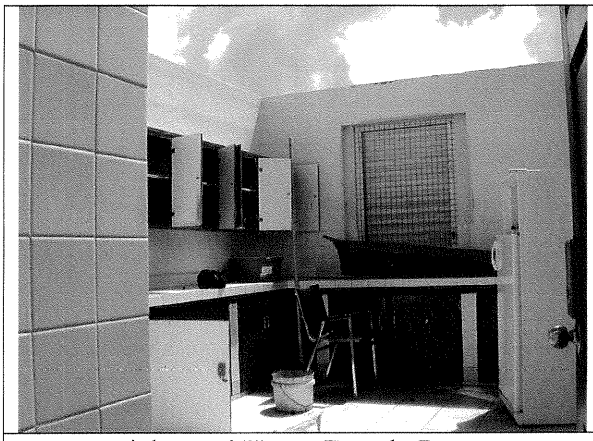
Princess Alice Doctor's Residence



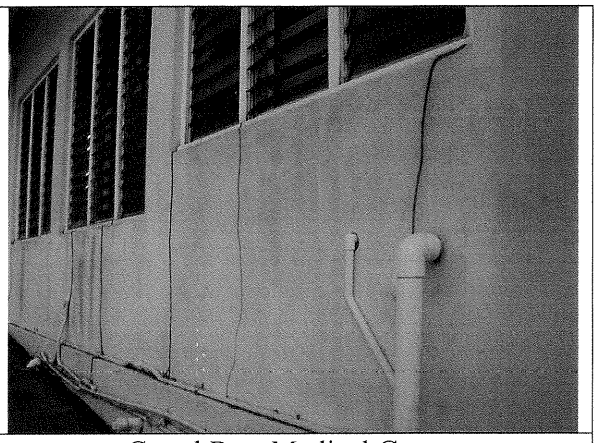
Psychiatric Hospital

Medical Stores Side Shed

Richmond Home Female Living Quarters

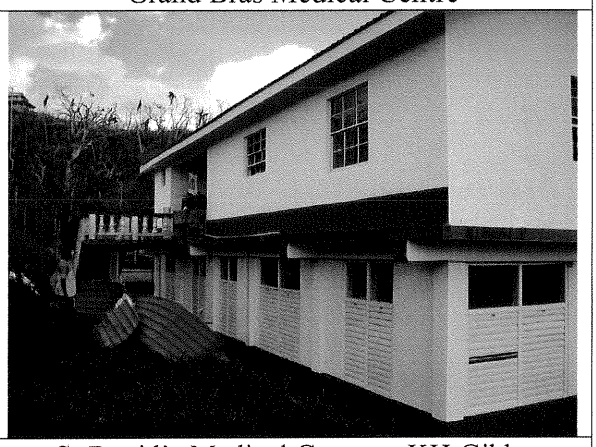


Richmond Home Female Pantry

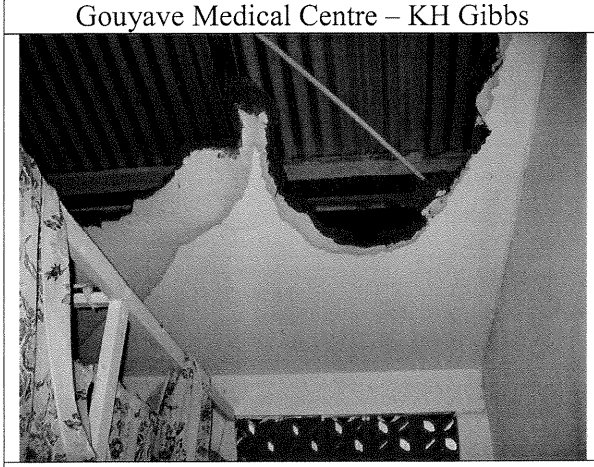


Grand Bras Medical Centre

Gouyave Medical Centre – KH Gibbs



St David's Medical Centre – KH Gibbs



Sauteurs Medical Centre – KH Gibbs

Sign on the St David's Road

Appendix B

Damage to Healthcare Facilities

	Grenada after Ivan	Area	Building Component													
	Damage to Health Facilities (% of item)	(Sq ft)	1	2	3	4	5	6	7a	7b	7c	8	9	10a	10b	11
	28th September 2004		foundations	walls	roof frame	roof cover	doors	windows	floor finish	wall finish	ceilings	cupboards	plumbing	elec conduit	elec wiring	suspend slab
1	**General Hospital**															
	Damage observed on 09 September 2004:															
	Windows, door, ceilings, roof sheeting															
	Damage (small)															

	Grenada after Ivan	Area	Building Component													
	Damage to Health Facilities (% of item)	(Sq ft)	1	2	3	4	5	6	7a	7b	7c	8	9	10a	10b	11
	28th September 2004		foundations	walls	roof frame	roof cover	doors	windows	floor finish	wall finish	ceilings	cupboards	plumbing	elec conduit	elec wiring	suspend slab
2	**Princess Alice Hospital**															
	Main hospital bldg	25,368	0	20	80	80	80	60	20	60	80	80	20	80	80	0
	including:															
	male ward															
	nurse's station															
	paediatrics															
	reception															
	A & E															
	pharmacy															
	doctor's office															
	kitchen															
	female ward															
	physiotherapy															
	maternity															
	Admin Blk	1,638	0	0	0	20	0	100	0	0	0	0	0	0	0	NA
	Generator Bldg	288	0	0	0	20	0	0	0	0	0	0	0	0	0	NA
	Incinerator	137	0	0	0	60	0	0	0	0	0	0	0	0	0	NA
	Mortuary	463	0	0	0	20	0	0	20	0	0	0	0	0	0	NA
	X-ray dept		0	20	40	60	20	20	20	0	60	20	0	0	100	NA
	including:															
	building	685														
	walkway	300														
	Doctor's home 1		0	20	100	100	100	80	20	20	100	60	0	100	100	NA
	including:															
	building	1,926														
	garage	399														
	Doctor's home 2		0	20	40	100	20	40	0	20	100	0	0	100	100	NA
	including:															
	building	928														
	patio	368														
	Pharmacist's Home		0	20	80	100	20	80	20	20	100	60	0	100	100	NA
	including:															
	building	2,330														
	garage	231														
	Nurse's Dorm		0	20	60	80	40	80	20	20	100	60	0	100	100	NA
	including:															
	building	6,405														
	garage	632														
	Princess Alice Hospital (total)	**42,096**														
	cf Ph-I figure (Damage 75%)	*15,000*														

	Grenada after Ivan	Area	Building Component													
	Damage to Health Facilities (% of item)	(Sq ft)	1	2	3	4	5	6	7a	7b	7c	8	9	10a	10b	11
	28th September 2004		foundations	walls	roof frame	roof cover	doors	windows	floor finish	wall finish	ceilings	cupboards	plumbing	elec conduit	elec wiring	suspend slab
3	**Psychiatric Hospital, Mt Gay**															
	Ward D & acute unit (2-storey)	8,306	0	0	0	40	0	0	0	0	20	0	0	0	0	0
	Generator room	160	0	0	0	0	0	0	0	0	0	0	0	0	0	NA
	Kitchen & store room	2,920	0	0	0	20	0	0	0	0	0	0	0	0	0	NA
	Dining rm & occupational thrpy (2-stry)	7,328	0	0	0	20	0	0	0	0	20	0	0	0	0	0
	Ward C (2-storey)	9,760	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Administration	3,105	0	0	0	0	0	0	0	0	0	0	0	0	0	NA
	Guard huts (2 number)	120	0	0	0	20	0	20	0	0	0	0	0	0	0	NA
	Covered walkways	800	0	0	0	20	0	0	0	0	0	0	0	0	0	NA
	Psychiatric Hospital, Mt Gay (total)	32,499														
	cf Ph-I figure (Damage 20%)	*15,000*														
4	**Medical stores**															
	Ramp	600	0	0	0	40	0	0	0	0	20	0	0	0	0	0
	Toilet	250	0	0	0	0	0	0	0	0	0	0	0	0	0	NA
	Main building	6,120	0	0	0	20	0	0	0	0	0	0	0	0	0	NA
	Timber shed	1,080	100	100	100	100	100	100	100	100	100	100	100	100	100	NA
	Medical stores (total)	8,050														
	cf Ph-I figure (Damage 20%)	*15,000*														

	Grenada after Ivan	Area	Building Component													
	Damage to Health Facilities (% of item)	(Sq ft)	1	2	3	4	5	6	7a	7b	7c	8	9	10a	10b	11
	28th September 2004		foundations	walls	roof frame	roof cover	doors	windows	floor finish	wall finish	ceilings	cupboards	plumbing	elec conduit	elec wiring	suspend slab
5	**Richmond Home, Richmond Hill**															
	Main building															
	including:															
	basement laundry	1,794	0	0	NA	NA	60	80	40	20	100	60	60	100	100	NA
	ground floor (female living quarters)	4,922	0	0	NA	NA	60	80	40	20	100	60	60	100	100	40
	first floor (male living quarters)	4,922	NA	20	100	100	60	80	40	20	100	60	60	100	100	40
	ground & first floors bath rooms	2,511	0	20	100	100	60	80	40	20	100	60	60	100	100	40
	two-storey nurse's quarters	2,982	0	20	100	100	60	80	40	20	100	60	60	100	100	40
	two-storey nurse's quarters	1,053	0	20	100	100	60	80	40	20	100	60	60	100	100	40
	one-storey nurse's quarters	324	0	0	0	40	60	80	40	20	100	60	60	100	100	NA
	Matron's quarters	289	0	0	0	0	0	40	0	0	0	0	0	0	0	NA
	Kitchen	799	0	0	0	20	0	20	0	0	0	0	0	0	0	NA
	Nurse's changing room	297	0	0	0	0	0	0	0	0	0	0	0	0	0	NA
	Physiotherapy unit (occupation, handicraft)	990	0	20	40	80	20	20	20	20	80	0	0	0	0	NA
	Mortuary	99	0	0	20	40	0	0	0	20	0	0	0	0	0	NA
	Richmond Home, Richmond Hill (total)	20,982														
	cf Ph-I figure (Damage 80%)	*15,000*														

	Grenada after Ivan	Area	Building Component													
	Damage to Health Facilities (% of item)	(Sq ft)	1	2	3	4	5	6	7a	7b	7c	8	9	10a	10b	11
	28th September 2004		foundations	walls	roof frame	roof cover	doors	windows	floor finish	wall finish	ceilings	cupboards	plumbing	elec conduit	elec wiring	suspend slab
6	**Grand Bras Medical Centre**	3,700	0	0	20	20	0	20	0	20	20	0	0	0	20	0
	including:															
	bottom clinic	1,000														
	top clinic	2,300														
	old washroom	200														
	gardener shed	200														
	cf Ph-I figure (Damage 3%)	*4,000*														
7	**Gouyave Health Centre, St. John**	4,700	0	0	20	20	0	20	0	20	20	0	0	0	20	0
	including:															
	student's quarters	500														
	nurse's quarters (back)	600														
	main bldg	2,300														
	garage	200														
	maternity unit	600														
	nurse's quarters (front)	500														
	cf Ph-I figure (Damage 5%)	*4,000*														
8	**Bellevue Med Centre, St. David's**	3,910	0	0	20	40	100	20	0	0	0	0	20	0	0	0
	including:															
	environmental health officer	740														
	clinic	2,282														
	nurse's quarters (front)	888														
	cf Ph-I figure (Damage 15%)	*4,000*														
9	**Sauteurs Med Cntr, St. Patrick's**	4,198	0	0	20	20	0	20	0	0	40	0	0	20	40	NA
	including:															
	nurse's quarters - I	940														
	nurse's quarters - II	888														
	main bldg	1,770														
	maternity unit	600														
	cf Ph-I figure (Damage 25%)	*4,000*														
	Note: Allow for inflation of 10%, Contingencies of 10% and fees of 12.5%															

	Grenada after Ivan	Common Utilities						
	Damage to Health Facilities (% of item)	12a	12b	13a	13b	14	15	16
	28th September 2004	water mains	water tank	sewage mains	sewage dispose	gas	telephone	cell phone
1	**General Hospital**							
	Damage observed on 09 September 2004:							
	Windows, door, ceilings, roof sheeting							
	Damage (small)							

	Grenada after Ivan	Common Utilities						
	Damage to Health Facilities (% of item)	12a	12b	13a	13b	14	15	16
	28th September 2004	water mains	water tank	sewage mains	sewage dispose	gas	telephone	cell phone
2	**Princess Alice Hospital**							
	Main hospital bldg	60	100	NA	0	0	0	NA
	including:							
	male ward							
	nurse's station							
	paediatrics							
	reception							
	A & E							
	pharmacy							
	doctor's office							
	kitchen							
	female ward							
	physiotherapy							
	maternity							
	Admin Blk	60	100	NA	0	0	0	private
	Generator Bldg	60	100	NA	0	0	0	private
	Incinerator	60	100	NA	0	0	0	private
	Mortuary	60	100	NA	0	0	0	private
	X-ray dept	60	100	NA	0	0	0	private
	including:							
	building							
	walkway							
	Doctor's home 1	60	100	NA	0	0	0	private
	including:							
	building							
	garage							
	Doctor's home 2	60	100	NA	0	0	0	private
	including:							
	building							
	patio							
	Pharmacist's Home	60	100	NA	0	0	0	private
	including:							
	building							
	garage							
	Nurse's Dorm	60	100	NA	0	0	0	private
	including:							
	building							
	garage							
	Princess Alice Hospital (total)							
	cf Ph-I figure (Damage 75%)							

	Grenada after Ivan	Common Utilities						
	Damage to Health Facilities (% of item)	12a	12b	13a	13b	14	15	16
	28th September 2004	water mains	water tank	sewage mains	sewage dispose	gas	telephone	cell phone
3	**Psychiatric Hospital, Mt Gay**							
	Ward D & acute unit (2-storey)	0	0	0	0	0	0	private
	Generator room	0	0	0	0	0	0	private
	Kitchen & store room	0	0	0	0	0	0	private
	Dining rm & occupational thrpy (2-stry)	0	0	0	0	0	0	private
	Ward C (2-storey)	0	0	0	0	0	0	private
	Administration	0	0	0	0	0	0	private
	Guard huts (2 number)	0	0	0	0	0	0	private
	Covered walkways	0	0	0	0	0	0	private
	Psychiatric Hospital, Mt Gay (total)							
	cf Ph-I figure (Damage 20%)							
4	**Medical stores**							
	Ramp	0	0	0	0	0	0	private
	Toilet	0	0	0	0	0	0	private
	Main building	0	0	0	0	0	0	private
	Timber shed	0	0	0	0	0	0	private
	Medical stores (total)							
	cf Ph-I figure (Damage 20%)							

	Grenada after Ivan	Common Utilities						
	Damage to Health Facilities (% of item)	12a	12b	13a	13b	14	15	16
	28th September 2004	water mains	water tank	sewage mains	sewage dispose	gas	telephone	cell phone
5	**Richmond Home, Richmond Hill**							
	Main building							
	including:							
	basement laundry	100	0	NA	0	0	100	private
	ground floor (female living quarters)	100	0	NA	0	0	100	private
	first floor (male living quarters)	100	0	NA	0	0	100	private
	ground & first floors bath rooms	100	0	NA	0	0	100	private
	two-storey nurse's quarters	100	0	NA	0	0	100	private
	two-storey nurse's quarters	100	0	NA	0	0	100	private
	one-storey nurse's quarters	100	0	NA	0	0	100	private
	Matron's quarters	100	0	NA	0	0	100	private
	Kitchen	100	0	NA	0	0	100	private
	Nurse's changing room	100	0	NA	0	0	100	private
	Physiotherapy unit (occupation, handicraft)	100	0	NA	0	0	100	private
	Mortuary	100	0	NA	0	0	100	private
	Richmond Home, Richmond Hill (total)							
	cf Ph-I figure (Damage 80%)							

	Grenada after Ivan	Common Utilities						
	Damage to Health Facilities (% of item)	12a	12b	13a	13b	14	15	16
	28th September 2004	water mains	water tank	sewage mains	sewage dispose	gas	telephone	cell phone
6	**Grand Bras Medical Centre**	0	0	NA	0	0	0	NA
	including:							
	bottom clinic							
	top clinic							
	old washroom							
	gardener shed							
	cf Ph-I figure (Damage 3%)							
7	**Gouyave Health Centre, St. John**	0	0	NA	0	0	0	NA
	including:							
	student's quarters							
	nurse's quarters (back)							
	main bldg							
	garage							
	maternity unit							
	nurse's quarters (front)							
	cf Ph-I figure (Damage 5%)							
8	**Bellevue Med Centre, St. David's**	0	100	NA	0	0	0	OK
	including:							
	environmental health officer							
	clinic							
	nurse's quarters (front)							
	cf Ph-I figure (Damage 15%)							
9	**Sauteurs Med Cntr, St. Patrick's**	0	0	NA	0	0	0	NA
	including:							
	nurse's quarters - I							
	nurse's quarters - II							
	main bldg							
	maternity unit							
	cf Ph-I figure (Damage 25%)							
	Note: Allow for inflation of 10%, Contingencies							

Appendix C

Repair Costs

24 September 2004

Grenada after Ivan

Repair Costs for Health Facilities (in EC$)

24th September 2004

				Estimated total reconstruction costs EC$	Estimated repair costs EC$
1	General Hospital				
	Damage observed on 09 September 2004: Windows, door, ceilings, roof sheeting				
	Damage (small)				$270,000
2	Princess Alice Hospital				
	Area	$15,000.00	sq.ft	(assumed, not measured)	
	Rate	$300.00			
	Total Cost			$4,500,000	
	Damage 75%				$3,375,000
3	Psychiatric Hospital, Mt.Gay				
	Area	$15,000.00	sq.ft	(assumed, not measured)	
	Rate	$300.00			
	Total Cost			$4,500,000	
	Damage 20%				$900,000
4	Medical Stores, Mt.Gay				
	Area	$15,000.00	sq.ft	(assumed, not measured)	
	Rate	$250.00			
	Total Cost			$3,750,000	
	Damage 20%				$750,000
5	Richmond Home, Richmond Hill				
	Area	$15,000.00	sq.ft	(assumed, not measured)	
	Rate	$250.00			
	Total Cost			$3,750,000	
	Damage 80%				$3,000,000

6 Grand Bras Medical Centre

Area	$4,000.00	sq.ft	(assumed, not measured)		
Rate	$250.00				
Total Cost			$1,000,000		
Damage 3%				$30,000	

7 Gouyave Health Centre, St. John

Area	$4,000.00	sq.ft	(assumed, not measured)		
Rate	$250.00				
Total Cost			$1,000,000		
Damage 5%				$50,000	

8 Bellevue Medical Centre, St. David's

Area	$4,000.00	sq.ft	(assumed, not measured)		
Rate	$250.00				
Total Cost			$1,000,000		
Damage 15%				$150,000	

9 Sauteurs Medical Centre, St. Patrick's

Area	$4,000.00	sq.ft	(assumed, not measured)		
Rate	$250.00				
Total Cost			$1,000,000		
Damage 25%				$250,000	

Total Repair Costs	$8,775,000		$3,250,000
	EC$		US$
Note: Allow for inflation of 10%, Contingencies of 10% and fees of 12.5%			$4,424,063
		say	**$4,420,000**
			US$

Appendix D

Repair Costs

30 September 2004

	Grenada after Ivan			
	Repair Cost Estimates	Line totals	Facility totals	Facility totals
	30th September 2004	EC$	EC$	US$
1	**General Hospital**			
	Damage observed on 09 September 2004:			
	Windows, door, ceilings, roof sheeting			
	Damage (small)	$270,000	$270,000	$100,000

	Grenada after Ivan			
	Repair Cost Estimates	Line totals	Facility totals	Facility totals
	30th September 2004	EC$	EC$	US$
2	**Princess Alice Hospital**		$5,192,370	$1,923,000
	Main hospital bldg	$3,173,724		
	including:			
	male ward			
	nurse's station			
	paediatrics			
	reception			
	A & E			
	pharmacy			
	doctor's office			
	kitchen			
	female ward			
	physiotherapy			
	maternity			
	Admin Blk	$43,200		
	Generator Bldg	$189,000		
	Incinerator	$1,000		
	Mortuary	$4,650		
	X-ray dept	$40,048		
	including:			
	building			
	walkway			
	Doctor's home 1	$505,060		
	including:			
	building			
	garage			
	Doctor's home 2	$259,200		
	including:			
	building			
	patio			
	Pharmacist's Home	$512,000		
	including:			
	building			
	garage			
	Nurse's Dorm	$464,489		
	including:			
	building			
	garage			

	Grenada after Ivan			
	Repair Cost Estimates	Line totals	Facility totals	Facility totals
	30th September 2004	EC$	EC$	US$
3	**Psychiatric Hospital, Mt Gay**		$449,000	$166,000
	Ward D & accute unit (2-storey)	$395,500		
	Generator room	$0		
	Kitchen & store room	$10,500		
	Dining rm & occupational thrpy (2-stry)	$32,000		
	Ward C (2-storey)	$0		
	Administration	$0		
	Guard huts (2 number)	$1,000		
	Covered walkways	$10,000		
4	**Medical stores**		$283,300	$105,000
	Ramp	$11,300		
	Toilet	$0		
	Main building	$110,000		
	Timber shed	$162,000		

	Grenada after Ivan			
	Repair Cost Estimates	Line totals	Facility totals	Facility totals
	30th September 2004	EC$	EC$	US$
5	**Richmond Home, Richmond Hill**		$1,571,919	$582,000
	Main building			
	including:			
	basement laundry	$104,500		
	grond floor (female living quarters)	$278,900		
	first floor (male living quarters)	$455,500		
	ground & first floors bath rooms	$244,500		
	two-storey nurse's quarters	$300,000		
	two-storey nurse's quarters	$106,500		
	one-storey nurse's quarters	$28,069		
	Matron's quarters	$0		
	Kitchen	$6,500		
	Nurse's changing room	$0		
	Physiotherapy unit (occupation, handicraft)	$44,100		
	Mortuary	$3,350		

	Grenada after Ivan			
	Repair Cost Estimates	Line totals	Facility totals	Facility totals
	30th September 2004	EC$	EC$	US$
6	**Grand Bras Medical Centre**	$116,400	$116,400	$43,000
	including:			
	bottom clinic			
	top clinic			
	old washroom			
	gardiner's shed			
7	**Gouyave Health Centre, St. John**	$162,900	$162,900	$60,000
	including:			
	student's quarters			
	nurse's quarters (back)			
	main bldg			
	garage			
	maternity unit			
	nurse's quarters (front)			
8	**Bellevue Med Centre, St. David's**	$160,900	$160,900	$60,000
	including:			
	environmental health officer			
	clinic			
	nurse's quarters (front)			
9	**Sauteurs Med Cntr, St. Patrick's**	$128,700	$128,700	$48,000
	including:			
	nurse's quarters - I			
	nurse's quarters - II			
	main bldg			
	maternity unit			
10	**Princess Royal Hospital, Carriacou**			
	Allow	$135,000	$135,000	$50,000
11	**Hillsborough Health Centre**			
	Allow	$67,500	$67,500	$25,000
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	Totals		$8,537,989	$3,162,000
	Allow for inflation of 10%, Contingencies of 10% and fees of 12.5%		$11,622,338	**$4,305,000**
		Line totals	Facility totals	**Facility totals**
		EC$	EC$	**US$**